HHV WORLD

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Editorial

As we step into the last quarter of the financial year, The HHV Group celebrates its 60th Anniversary alongside the 100th birth anniversary of our founder, S.V. Narasaiah, a visionary who shaped India's advancements in space and defense research. His legacy continues to inspire us as we expand and innovate.

This year, HHV Advanced Technologies (HHV AT) established a 40,000-square-foot Optics Fabrication and Thin Film Coating Facility, enhancing our capabilities to meet growing global demand for precision optics and advanced coatings. At the same time, HHV Thermal Technologies (HHV TT) has maintained its leadership in cutting-edge furnaces for metallurgical applications for over 60 years. We are proud to have received a prestigious super-speciality brazing furnace order from Korea, further solidifying our global reputation. Additionally, HHV TT is working on carbon-carbon composites and carbon-silicon composites for critical space applications.

Recent achievements by HHV AT include innovations like DLI-Based PECVD Systems, Commander Sight Germanium Windows, and Ultra-Low Reflection Coatings, which have elevated our offerings in advanced optics and thin film coatings. The introduction of the Dual Ion Beam Sputtering System has further enhanced our ability to deliver world-class precision coatings for demanding applications.

HHV TT, on the other hand, has pioneered breakthroughs such as the Vacuum Aluminium Brazing Furnace and the Top-Loading High-Temperature Tungsten Vacuum Furnace. Highlighted in this issue are two significant innovations: the Film Boiling – Chemical Vapour Infiltration Facility, which is among the fastest methods for producing high-quality carbon composites, and the High Vacuum Atomization Chamber, designed for additive manufacturing applications. These advancements demonstrate HHV TT's leadership in materials engineering and support for cutting-edge technologies like aerospace systems.

We continue to foster innovation through collaborations such as our MoU with REVA University and remain deeply committed to community engagement with initiatives like the 'Chittara' Mural CSR Project. Our presence at key events, including Bangalore Space Expo 2024, LWOP 2024, and the 8th National Symposium on Shock Waves (NSSW 2024), highlights our commitment to collaboration and technological excellence. Alongside these milestones, team celebrations such as Ayudha Pooja, the Annual Sports Meet, and New Year 2025 further strengthened our spirit.

As we reflect on the past and look ahead to the future, HHV continues to push boundaries, combining innovation, expertise, and collaboration to deliver world-class technologies. Inspired by our founder's vision, we remain committed to shaping the future with excellence and purpose.

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Film Boiling – Chemical Vapour Infiltration Facility

Film Boiling Chemical Vapor Infiltration (FB-CVI) is a process developed to increase both the carbon yield and the densification rate for a controlled type of pyro carbon deposit. It is one of the fastest methods for producing carbon fibre reinforced carbon (CFRC) composite products.

Film Boiling refers to a process in which a self-standing fibre preform, heated with a susceptor, is immersed in a boiling liquid precursor. This process generates a steep temperature gradient in the preform and facilitates efficient precursor mass transfer, resulting in the densification of the material.

Chemical Vapor Infiltration (CVI) is a process where chemical vapours penetrate porous structures to deposit materials within the object's 'body'.

HHV TT has recently designed, manufactured, and supplied a totally automated film boiling chemical vapour infiltration facility with automatic process control system.

FIG 1. Film Boiling – Chemical Vapour Infiltration Facility

What it does?
CVI of cyclohexane as precursor is performed on preforms of maximum size of 1000 x 500 x 500 mm to achieve Carbon Composite products. The process is conducted in the main reactor chamber and well assisted by various sub-systems like sensors and control instrumentations, safety systems and dedicated power supplies with complete automation.

HHV TT's FB-CVI facility consists mainly of a reactor chamber, furnace stilling vessel, liquid vapour separator and vapour exhaust chamber with various sub-systems.

The reactor chamber has 3 segments of 1200 mm diameter in size. These furnace segment's structure is to maintain distance between the feed through and to accommodate jobs

The furnace stilling vessel draws the liquid from the top and bottom of the reactor to monitor the liquid quantity in the reaction chamber through a level sensors.

The liquid vapour separator has 3 layers of honeycomb assembly vanes. The vapours coming out from the job will be passing through these vanes and demister pad where most of the high density vapours will get condensed.

The precursor transfer system comprises of a precursor transfer system to transport precursors during the process. Dedicated pumping system with redundancy is provided to carry out all the above operations.

The Cyclohexane is transferred from the reaction chamber to collector tank. The cyclohexane from the collector tank is filtered in two stages of sizes 1 µ & 0.1 µ respectively and transferred to liquid storage unit.

The FB-CVI process use cyclohexane as precursor liquid for the densification of C-C composites. Considering the highly flammable nature of cyclohexane, the gas detection system will be based on infrared gas sensors.

The byproducts generated during the pyrolysis of cyclohexane which are non-condensable along with N_2 used for inerting purposes are vented to the atmosphere through a chimney. The uncondensed gases are passed through a trap chamber to remove the condensable vapors before entering the chimney.

Overall system level safety of FB-CVI is ensured with all relevant national/international standards.

A High Vacuum Atomization Chamber for Additive Manufacturing

Fig 1. High Vacuum Atomization Chamber

Additive Manufacturing
Additive Manufacturing (AM) has a strong impact on metallic powder production in development of powder-based metal manufacturing processes.

The manufacture of metal powders is generated from the process of gas atomization, plasma atomization, and plasma rotating electrodes process atomization, etc. Metallic powders for additive manufacturing (AM) processes are primarily produced by gas atomization.

Atomization
Atomization refers to breaking bonds in molten metal to obtain its constituent atoms by forcing through nozzle at high pressure in gas phase, and it also means separating something into fine particles.

Plasma Atomization
Plasma Atomization (PA) is a powder manufacturing process that has been developed to produce high purity metal powders in a wide variety of size ranges. The application of plasma process is a growing field in important engineering technologies.

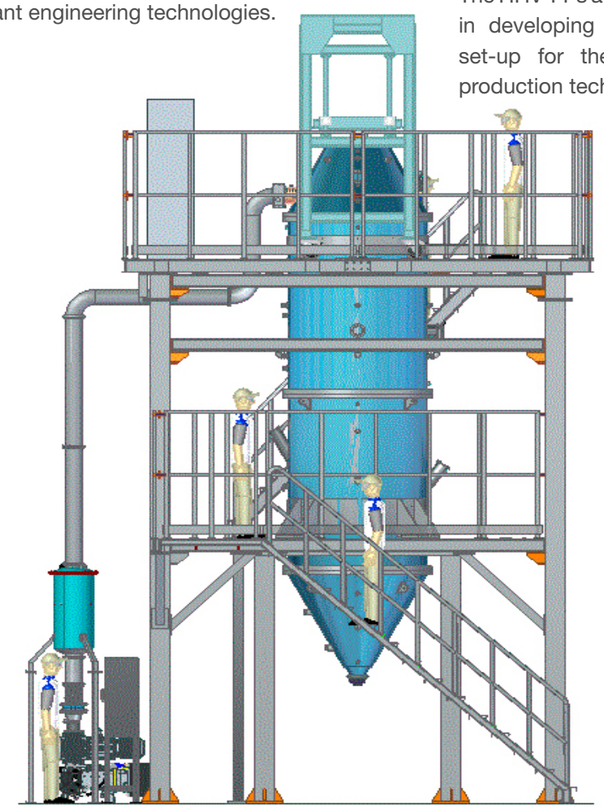


Fig 2. High Vacuum Atomization Chamber

Atomization chamber with pumping system
HHV TT has recently designed, manufactured, supplied and commissioned a vertically mounted cylindrical vacuum atomization chamber with a high vacuum system for additive manufacturing.

The double walled water-cooled cylindrical vacuum atomization chamber with cooling capacity of 200 kW has two parts of each size of 1416 mm internal diameter x 4000 mm height. It is equipped with all required safety systems.

The programmable logics control system, and the instrumentation control systems installed enables automated vacuum cycle to achieve various interlocks and safety.

A high vacuum system enables to create a vacuum of 1 x 10^{-3} mbar in 45 minutes.

Establishing stable atomization conditions is a key factor to manufacture high quality metal powders tailored for AM processes.

The HHV TT's atomization vacuum system is utilized in developing plasma molten metal atomization set-up for the development of metal powder production technologies.

Dual Ion Beam Sputtering System

HHV AT's state-of-the-art Dual Ion Beam Sputtering (DIBS) system is fully automated and is capable of depositing multilayer dielectric films up to several microns thick. The system design ensures the deposited films are dense, smooth, stable, and have very low absorption coefficients.

Dual Ion Beam Sputtering (DIBS) is a direct method for forming high-purity solid films on a substrate by irradiating a high-energy, ion beam of solid material in a high vacuum environment. By this method, we can obtain isotopically enriched high-purity metal or semiconductor films. Furthermore, we can control the film properties by selecting the ion irradiation energy.

The primary ion source is used for target sputtering process and a secondary source is used for film growth modifications (assist operation) or for surface modifications of the substrate (cleaning, smoothing).The system geometry is designed so the sputtered target material arrives at the substrates while ions from the second source (assist source) are also arriving.

Fig.1. Dual Ion Beam Sputtering (DIBS) System

We have just installed our brand new DIBS system at RRCAT, Indore, a unit of Department of Atomic Energy (DAE), Government of India, which uses dual ion-beam sputtering to generate high quality optical coatings for antireflection, high reflection for laser bar facets. We can deposit hundreds of layers with sub-nm accuracy. The system is equipped with 3 grid RF ion source to focus on the 100 mm diameter target, which enables high quality films over a 100 mm diameter substrate. An End-Hall type ion source for precleaning and assistance during sputtering, water cooled four target carousal for multilayer deposition, Cryo based pumping system, RGA, Load-Lock Transfer System with dedicated pumping system to do many coating runs without the need to vent the deposition chamber, cooling water system, electric cabinet and so on.

The scope of HHV AT includes the identification of the appropriate coating system configuration, the design and development of the system, and qualifying the processes at the customer premises. Based on the customer requirements, coating processes can be developed and qualified during the execuation phase. Dedicated test set-ups are available at our factory.

Chamber (mm)	Standard	Optional
Width	500	1000
Diameter	600	700
Height	700	1000

Pumping System	
Standard	Optional
Turbo molecular pump 8 inch	Cryo pump 10 inch
Scroll dry pump	Multi-stage roots pump

Ion Sources		
Deposition	Standard	Optional
Beam Size	4 cm	Up to 14 cm
Discharge	2 MHz, RFICP	

Preclean and Assist	
Standard	Optional
Gridless: End hall source	Gridded sources up to 14 cm

Performance		
Base pressure	:	< 1 x 10^{-7} mbar
Time to reach	:	1 x 10^{-6} mbar < 1 hour
Uniformity	:	± 2% over 4" diameter

Ultra-Low Reflection Coating for Cinematography

Ultra-Low Reflection (ULR) lenses, with reflectance less than 0.25% across the visible spectrum of 420 nm to 680 nm, are revolutionizing photography, videography, and optical imaging.

The lenses are meticulously designed to overcome the challenges of glare, light loss, and reflections that photographers and cinematographers face every day. When light interacts with a lens, a portion is reflected away, leading to darker images, reduced contrast, and unwanted artifacts. ULR lenses tackle this problem head-on, allowing more light to pass through for brighter, clearer, and sharper visuals - even in challenging lighting conditions such as harsh sunlight or dim light environments.

What sets ULR lenses apart is their ability to dramatically reduce lens flare and ghosting those streaks or reflections that can spoil an otherwise perfect shot. By enhancing contrast and bringing out the vibrancy of colours, they ensure images are rich, and breathtakingly detailed. From capturing the glow of a sunset to the intricate patterns of microscopic specimens, ULR lenses retain every nuance of light and shadow, elevating image quality to an unmatched level of brilliance. These advanced optics have become indispensable in industries ranging from professional photography, filmmaking to astronomy and scientific research.

The Optics of ULR Lenses:
For the first time in our history, HHV AT is proud to introduce our ultra-low reflection coatings for special lenses—a monumental leap in optical engineering. These lenses, with refractive indices spanning from 1.44 to 1.85, represent the culmination of advanced scientific design and expert craftsmanship.

The journey to create these lenses is challenging. Each lens begins its transformation with precise curve generation to achieve the ideal surface geometry. This is followed by lapping and polishing processes that ensure an impeccably smooth surface. The centring process aligns the optical axis with meticulous accuracy, while edge blackening eliminates stray light and further enhances the clarity of the final image. Every step is executed with unwavering attention to detail, ensuring that our lenses meet and exceed the highest performance standards.

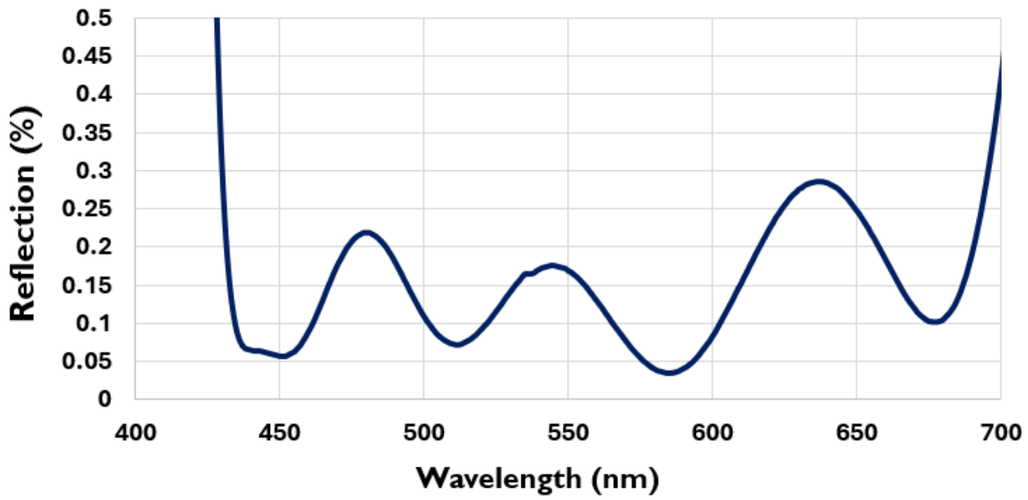


Fig.1. Reflection as a function of wavelength

The Science Behind ULR Coatings:
The development of HHV AT's ULR coatings is rooted in a sophisticated multilayer stack approach. This design leverages alternating layers of high and low refractive index dielectric materials. These layers, meticulously engineered in both composition and thickness, work together through constructive and destructive interference to minimize reflections and optimize light transmission.

The layer thicknesses are calculated with nanometre precision to ensure minimal reflection across the critical wavelength range of 420 nm to 680 nm. This precise control enables the coatings to achieve an astonishingly low reflectance of less than 0.25%, resulting in an impressive light transmission rate of >99%. Such efficiency transforms the performance of optical systems, enabling lenses to capture and transmit almost all available light, resulting in images of exceptional brightness, clarity, and detail.

The Art of Coating Application:
Creating ULR coatings is as much an art as it is a science. It begins with selecting dielectric materials that are both transparent and non-absorbing across the visible spectrum. These materials are carefully chosen to construct the alternating high- and low-refractive index layers that give ULR coatings their unique optical properties.

Substrate preparation is equally critical. The base of the lens must be flawlessly clean and free from even the tiniest contaminants. This involves meticulous cleaning using ultrasonic baths and chemical treatments in a controlled environment to ensure a pristine surface for the coating to adhere.

The coating process itself is executed using ion-assisted electron beam evaporation in a high-vacuum chamber. This technique allows for unparalleled precision, where factors like substrate temperature, ion gun settings, deposition rate, and vacuum pressure are finely controlled. Each layer is deposited with sub nanometre-level accuracy to achieve the exact optical performance required.

Our ULR coatings undergo rigorous testing to meet the stringent MIL-PRF-13830B standards. These tests ensure that the coatings are not only optically superior but also incredibly robust. They are evaluated for adhesion to prevent peeling, abrasion resistance to endure wear and tear, and durability against humidity, salt exposure, and extreme temperature cycles.

The result is a lens coating that is as reliable as it is advanced. This comprehensive process from material selection and precision coating to rigorous testing represents a significant achievement in optical technology. It is a proud milestone for HHV AT, setting a new standard in the world of ultra-low reflection coatings and positioning us as leaders in the optical industry.

Fig.2. Optical lenses

Protective Window for Sight Applications

Crown glass has good optical and mechanical properties and are resistant to chemical and environmental damage and are hence preferred for protective windows.

Fig.1. Protective Window

The optical transparency of the window extends from the visible to near-infrared range (350-2000 nm) transmitting about 90-92 % in visible and 80-85% of light in near-infrared range. Protective windows are mostly employed as a gunner's viewing port that forms a part of tanks in the Indian army.

Optics of protective window

For the first time in our company's history, we have developed a protective window sub-assembly used in tanks by the Indian military indigenously. It is an optoelectrical sub-assembly involving optics (window) fabrication, coating the window, and assembling it with electrical heaters and outer frames.

This profiled window, made of crown glass, has 4 radii on the edges, and a 4 mm groove on the outer periphery with two key slots for retaining the coil for the heater. The grooves on the glass are made with special form wheels using a 5-axis CNC machine (MCG150 imported from Germany). Additionally, the window calls for the stringent flatness requirement of 0.5 fringes for the bigger diagonal of 168 mm. This strict flatness is specified for meeting the functional requirement of resolving power of 17". The required high degree of flatness is achieved by the float polishing process developed by HHV AT.

The optics process involves milling, grooving, double side lapping, double side polishing, float polishing, thin film coating on both sides, and the final assembly of fixing the heaters and frames using sealant. The final assembly is tested for functionality and aesthetic requirements.

Coating of protective window

To further enhance the visibility of these windows, especially in the case of a gunner's viewing port, applying an anti-reflective (AR) coating is a practical solution, as the increased clarity can be crucial for operational effectiveness. AR coatings not only enhance the optical performance of protective windows by reducing reflections but also contribute to the overall durability and effectiveness of the viewing port in demanding environments.

Although it is very much possible to create an AR coating design for the full transparency range of the window material, this application requires the increased transmission in a much shorter wavelength band, i.e., 560±20 nm. In such cases of requirements, designing a V-coat is more beneficial. A V-coat is a typical 2-layer AR coating design that is targeted to bring down the reflection in a smaller wavelength range. It involves coating only 2 layers, one with a high refractive index and the other with a low refractive index dielectric material on the substrate. The thickness of these layers is precisely engineered to achieve minimal reflection at a specific wavelength range. The V-coat is optimized for high efficiency in a narrow wavelength range. With this, in the targeted wavelength range, the V-coat can achieve very low reflectance, typically less than 0.3%.

To fully realize the potential of the V-coating, firstly, it is important to choose the materials that are transparent and non-absorbing in the wavelength region of interest to create the design. Secondly, the substrate (window) must be carefully handled and meticulously cleaned to remove any contaminants, dust, or residues that might affect the coating's adhesion and uniformity. Then, for the execution part, the rate of deposition must be optimized for each material to ensure precise layer formation in the controlled vacuum atmosphere using the ion-assisted electron beam evaporation technique. Monitoring the set process parameters such as substrate temperature, ion gun parameters, deposition rate, and vacuum pressure is important to ensure the coatings are applied uniformly and adhere properly to the substrate. Post coating, the window is moved to the next stage for integration into an optoelectrical sub-assembly.

HHV AT has been successful in executing V-coatings with high AR performance across various wavelength ranges. This highlights HHV AT's capability to deliver tailored optical solutions that meet specific customer requirements.

Fig.2. Protective Window

Celebrating S V Narasaiah, 100 Years who shaped India's Vacuum Industry

Freedom fighter-turned-technologist, the late S V Narasaiah, was celebrated in Bengaluru on Saturday, 28th September 2024 for his pivotal role in shaping India's space and defence research, especially after the country faced technological embargoes following the 1974 Pokhran nuclear test.

S V Narasaiah was known for his contributions to Vacuum Technology, which has permeated every aspect of modern life from stainless steel flasks to hypersonic wind tunnels. But few know that Narasaiah's journey began at 38, following an already remarkable career.

Having participated in the freedom struggle, publishing an underground newspaper, creating documentaries, and working as a photojournalist in the Eastern Bloc, he eventually turned his attention to manufacturing zoom and telephoto lenses to offset the expensive imports at the time.

His sons Nagarjun and Prasanth Sakhamuri recalled his journey on the sidelines of a programme organised at IISc. With help from friends at the Indian Institute of Science (then known as Tata Institute), Narasaiah reverse-engineered the necessary technology. "He created his own machine and eventually began selling it to academic and industrial clients," Nagarjun said. This humble beginning led to the founding of Hind High Vacuum Co. (P) Ltd (HHV), an enterprise specialised in vacuum technology.

Prasanth said: "Following the nuclear test in Pokhran, western nations imposed an embargo on Vacuum Technology — a technology crucial for atomic energy applications. The flow of advanced technology to India abruptly stopped. For many, this would have been a crippling blow, but for him (Narasaiah), it was an opportunity to rise to the challenge.

The scientific and research community rallied around HHV during that time, offering their full support. Vacuum Technology had become a matter of national importance, and whenever there was acritical challenge, many scientists would turn to Narasaiah for solutions. And he never backed down from a challenge," he added.

SVN, as he was fondly called, went on to become the director of the small-scale industries association (KASSIA) in Karnataka and was the founding member of the Indian Vacuum Society. He was an active member of the American Society of Metals and was recognised for his services by the India chapter in 2019. Some of the most challenging projects HHV undertook under Narasaiah's leadership included a robotic coater for the LCA (Light Combat Aircraft) programme and a Hypersonic Wind Tunnel for ISRO.

His sons recalled an adage that Narasaiah stood by: “If I don’t have the confidence to support another Indian manufacturer, why should others have confidence in me?” —a true testament to his belief in the power of ‘Make in India’ long before it became a national movement.

Most of his ventures began with a simple curiosity—vacuum flasks, for example. His passion for innovation led him to develop stainless steel vacuum flasks in 1987, long before they became common. Similarly, he pursued projects in compact fluorescent lamp equipment and thin-film solar technology, always ahead of his time, looking for the next breakthrough. Most of the time, it was in the market at the wrong time. As far back as the1970s, he built a solar water heating system for his home—a novelty at that time when wood dust or electric immersion heaters were the norm.

“SV Narasaiah stood for entrepreneurship and innovation. I can’t believe that 60 years ago, he thought of starting a company. These are visionaries because of whom India is what it is today, and we should celebrate their achievements and not forget them,” said Prof V Ramgopal Rao, group vice-chancellor, BITS Pilani Group who delivered the keynote lecture during the event.

Article Courtesy: Times of India

Certificate for 4-Layer Metallization Process

HHV Advanced Technologies Pvt Ltd is proud to announce that we have successfully obtained the Certificate for our 4-layer metallization process. This achievement underscores our commitment to excellence and innovation in semiconductor manufacturing.

भारत सरकार
अन्तरिक्ष विभाग
यू.आर. राव उपग्रह केन्द्र
पोस्ट बॉक्स नं.१७९५, ओल्ड एयरपोर्ट रोड,
विमानपुरा डाक, बेंगलूरु - ५६० ०१७, भारत
दूरभाष :
फैक्स :

इसरो ISRO

Government of India
Department of Space
U.R. RAO Satellite Centre
Post Box No. 1795, Old Airport Road
Vimanapura Post, Bengaluru - 560 017, India
Telephone :
Fax :

SRQA-PAD-CT-02 20-Jan-2025

Certificate of Qualification

U. R. Rao Satellite Centre (URSC) has qualified photolithography process & scribing of 4-layer thin film metallized substrates Cr-Cu-Ni-Au & TiW-Cu-Ni-Au upto size 2" x 2" from HHV Advanced Technologies Pvt Ltd.

This certificate is issued after successful completion of process qualification.

Reference Documents:

Sl no	Document Name	Ref no
1	Process Identification Documents (PID):	
a	Pattern generation of 4-layer TiW-Cu-Ni-Au metallized thin film substrates	PID/HHVAT/ URSC / TiW – 4L/01 Dt: 26.06.2024
b	Pattern generation of 4-layer Cr-Cu-Ni-Au metallized thin film substrates.	PID/HHVAT/URSC/Cr–4L / 01 Dt: 26.06.2024
2	Qualification of Photolithography Process on four layer Thin film metallised substrates from M/s HHV	PAD/HHV/ PQ-01 Dt:23-10-2024

Validity: This certificate is valid till **31st October 2026.**

Jagannath Das
Deputy Director, SRQA

Ramalakshmi N
Associate Director (R&D), URSC

To:
M/s HHV Advanced Technologies Pvt Ltd, Bengaluru

भारतीय अन्तरिक्ष अनुसंधान संगठन INDIAN SPACE RESEARCH ORGANISATION

We are honoured to receive this certification from the U R Rao Satellite Centre (URSC), a lead center in India for the design, development, and realization of all ISRO - Indian Space Research Organization satellites.

Our dedicated team has worked diligently to meet URSC's stringent criteria, and this certification validates our advanced technology and robust quality assurance processes.

It positions us to enhance our product offerings and serve our clients with increased precision and reliability.

We extend our sincere gratitude to all team members involved in this accomplishment.

We look forward to leveraging this certification to further advance our technology and contribute to the evolving demands of the industry.

Chittara Mural When Art Meets Science

At HHV Advanced Technologies, we take pride in supporting endeavours that celebrate heritage and push boundaries.As supporter of the stunning Chittara mural at Science Gallery Bengaluru, we're honoured to help bring this traditional Karnataka art form to life.

Created by talented artists Sunil Mishra, Nithin Kumar D, Ashwath K, and Poornima Rao, and an inspired design by Namrata Cavale, the mural perfectly captures the essence of merging heritage with modern spaces.

HHV Advanced Technologies is proud to champion the spirit of collaboration and creativity. Supporting culture is just as important as creating cutting-edge technology—because innovation is built on the foundations of imagination and inspiration.

If you're in Bengaluru, don't miss this extraordinary blend of art and science at Science Gallery BLR . Together, we're painting a brighter, more innovative future!

Memorandum of Understanding (MoU) with REVA University

We are delighted to announce that HHV Advanced Technologies Pvt Ltd, Bangalore, has officially signed a Memorandum of Understanding (MoU) with REVA University! This strategic partnership marks a significant milestone in our commitment to fostering innovation and excellence in education and technology.

Through this collaboration, we aim to leverage our combined expertise to enhance research initiatives, develop cutting-edge technologies, and provide valuable opportunities for students and faculty alike. Together, we are dedicated to driving advancements that will benefit the broader community and industry.

A heartfelt thank you to everyone involved in making this partnership a reality, especially Smriti Sakhamuri, Dr. Naveen C S and Dr. Sunitha D V. We look forward to a fruitful journey ahead, filled with shared successes and groundbreaking developments.

SEMICON 2024, New Delhi, India

Hon'ble Minister of State of IT & BT and Science & Technology, Government of Karnataka Priyank M Kharge visited the ASM-HHV Engineering Pvt. Ltd. booth at SEMICON India 2024 (September 11-13, 2024) at the India Exposition Mart Limited (IEML), Greater Noida.

ASM-HHV Engineering is a joint venture between ASM Technologies and the HHV Group . With over 60 years of experience in design, engineering and manufacturing, ASM and HHV have partnered and established India's first semiconductor focused equipment manufacturing facility.

ASM and HHV have expertise in designing and manufacturing semiconductor tools, sub-systems, systems components and providing field support.

Laser World of Photonics (LWOP), 2024
Mumbai, India

HHV Advanced Technologies Pvt. Ltd. was excited to see the remarkable interest in our defence and security solutions alongside our cutting-edge photonics and laser technologies.

HHV AT experts were seen showcasing innovations tailored to various industries during the Laser World of Photonics 7th-9th September 2024 India, from precision optics and lasers to advanced defence and security solutions.

It was a fantastic opportunity to connect with leaders and innovators interested in leveraging these technologies to meet industry demands and achieve strategic goals.

Bangalore Space Expo 2024
Bengaluru, India

The HHV group showcased its range of products and capabilities suited for the India space sector in 8th Bengaluru Space expo 18th-20th September 2024.

The HHV group is India's Premier vacuum science and technology company with over 60 years of experience in the design and manufacture of vacuum furnaces, thin film coating equipment and high precision optics

8th National Symposium on Shock Waves (NSSW 2024)
Indian Institute of Technology, Kanpur, India

HHV TT participated in the National Symposium on Shock Waves NSSW 2024 held at IIT , Kanpur, India on 12th-15th November 2024 and the large project executed by HHV has been showcased in the exhibition.

It was well received by the researchers, Scientists working on Shock Waves and its application and Hypersonic inspired with the HHV's large size Hypersonic shock tunnel and Hypersonic Wind tunnel, etc.

ISAMPE Colloquium and Exhibition on Composites, ICEC, 2024
Thiruvananthapuram, India

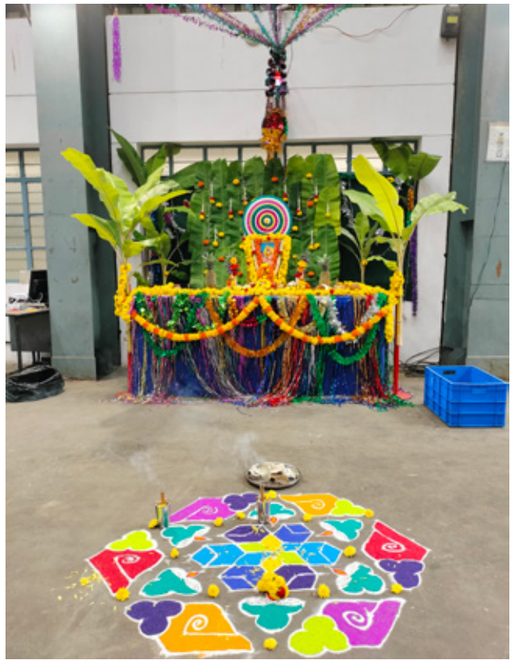
Composites have played a pivotal role in the past and are evolving for the next generation of technologically challenging Space Missions.

HHV TT displayed its range of Carbon-Carbon Composites products in ICEC, 2024 Thiruvananthapuram, India.

It was organised by ISAMPE in collaboration with Vikram Sarabhai Space Centre (VSSC) on 22nd and 23rd November 2024 with the theme: 'Achieving Self-Reliance in Aerospace Composites through Indigenisation, Innovation, and Industry Partnerships for Atmanirbhar Bharat'.

It was an opportunity to prove HHV TT's strength and capability in manufacturing composites to the researchers, experts, and student involved in advancing aerospace applications through the strategic indigenisation of composite products.

Ayudha Pooja 2024
Bengaluru, India



At HHV Ayudha pooja was celebrated at all the manufacturing units on 10th October 2024. During this occasion, Office, Machines and Tools were diligently cleaned and worshipped.

HHV believes that it is a powerful of acknowledging the significance of these machines and tools in everyone's life.

Annual Sports Meet 2024
Bengaluru, India

Sports and games have always been an integral part of the culture and is a fantastic team building event.

HHV organised an annual sports meet on 23rd, October 2024 at Aditya cricket ground, Nelamangala Bengaluru. Cricket, and fun and enjoyable game for kids and family members are the highlight of the event.

All the HHV group employees participated with their family members enthusiastically which made it a memorable event.

Annual Health Check-Up Camp, 2024
Bengaluru, India

HHV TT has conducted a health checkup for the employees to ensure their occupational safety and health. It was organised in premises on 6th December 2024. HHV ensures each and every employee's health at work by organizing regular health check up camp and discussion with employees.

New Year 2025
Bengaluru, India

HHV celebrated new year 2025 with "as we look to 2025" we focus on capitalizing on the opportunities ahead, nurturing the relationships we have built, and continuing to excel in everything we do. This year has not been without its challenges. Let us carry forward the sprit of collaboration and perseverance, that defines us, embracing both the highs and lows as part of our shared journey.

NSI-44, IISc 2025
Bengaluru, India

Dr. M.G.Sreenivasan was part of a panel discussion at the National Conference on Instrumentation, Measurement, Sensors, and Transducers (NSI-44) on 10th and 11th January 2025 at the Department of Instrumentation, IISc, Bangalore.

This conference was jointly organized by Indian Institute of Science and Instrument Society of India.

The venue of the conference was the S. V. Narasaiah Auditorium which has been set up at IISc in memory of the late chairman of the HHV Group.

The panel consisted of members from the industry and the academia. The discussions and debates were centred around the following questions:

- Does the Indian engineering education system equip students with the skills for instrument development? What are the strengths and what are the weaknesses of our undergrad/grad education in this regard
- What reforms can be introduced in academia to better facilitate this?
- What mindset change has to happen in Industries?
- These questions made for some engaging discussions stretching well beyond the scheduled timeslot at the end of which both sides took notes on the steps to take moving forward.

Industrial Visit from SUNY Oswego, 2025
Bengaluru, India

Learning without boundaries!!!

The students from State University of New York at Oswego visited HHV in January 2025 with the support of World strides higher education custom program.

SUNY Oswego has built a legacy of shaping the world for more than 160 years through the remarkable achievement of talented alumni, students and faculty.

It was wonderful hosting students. We hope the visit shed more light into know-how of Optics & Thin Films industry.

Hind High Vacuum Company Pvt. Ltd.

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